Understanding the Relationship Between Oxygen Flow Rate and FiO2

CPD 7m Updated 15 Apr 2025 • 3,226 Ratings •

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Oxygen - we all need it! Sometimes we need more of it in order to ma
saturations. In these situations, supplemental oxygen can be adminis
oxygen delivery devices, ranging from nasal prongs to invasive venti

There are two important things to consider when delivering supplemental oxygen to y

1. The **oxygen flow rate**
2. The **FiO^2**.

The **oxygen flow rate** is the number that we dial up on the oxygen flow meter, usually

FiO^2 (the fraction of inspired oxygen) is defined as the percentage or concentration o
inhales.

The atmospheric air that we inhale on a day-to-day basis is made up of 21% oxygen, 7
trace elements such as argon, carbon dioxide, neon, helium and methane.

What is the FiO^2 of the Oxygen You are Delivering to You

In order to answer this question, I am going to ask you a series of questions!

My first question: What is the FiO^2 of the air you are breathing right now?

... If you said 21%, excellent!

**My second question for you is this: What is the FiO^2 of the oxygen being de
oxygen flow meter as soon as you turn it on?**

This is where people start saying, 'It depends on the oxygen flow rate.' This may be tr
but when we are discussing FiO^2, it is not actually correct.

**Therefore, my third question for you is this: Does the oxygen flow rate reall
the *pure* oxygen that is being delivered through the oxygen flow meter?**

The answer is ***no***! The oxygen flow metre is connected to either a bottle of oxygen or
oxygen. This oxygen ***is*** pure: it is 100% oxygen! Therefore, anything that comes out of
has an FiO^2 of 100%.

Consider the following:

- If I have the oxygen flow rate set at 1 L/min, I will have 1 L/min of 100% oxygen ...
- If I have the oxygen flow rate set at 5 L/min, I will have 5 L/min of 100% oxygen ..

- If I have the oxygen flow rate set at 10 L/min, I will have 10 L/min of 100% oxyger
- If I have the oxygen flow rate set at 15 L/min, I will have 15 L/min of ... ?

... If you said 100% oxygen, excellent!

But my patient receiving 1 L/min of oxygen via the nasal pron breathing in a FiO^2 of 100%, are they?

Of course not! **The true FiO^2 the patient is breathing is based on the flow requiremer**

What do I mean by that? You are currently breathing air in and out of your lungs. The a has to get from **point A (the atmosphere) to point B (your lungs)**. If a car is trying to g B, it can only do this if you press the accelerator to achieve a certain speed. The faste you get from point A to point B. The same principle applies to how we breathe, but we our **peak inspiratory flow**.

Our normal peak inspiratory flow tends to range between 20-30 L/min. Our respirator comfortable and do not tire when we breathe at a normal respiratory rate with this pe consider a patient who is 'struggling to breathe' or has an 'increased work of breathin faster and deeper to try to get the air from point A to point B faster.

This means that their peak inspiratory flow requirement has increased.

What is the Relationship Between Oxygen Flow Rate, FiC Inspiratory Flow?

If you are breathing in **normally** at a peak inspiratory flow rate of 30 L/min at room air can easily calculate the average FiO^2 you are breathing in an almost redundant formul

$$30 \times 21 = 630\%$$

$$630 \div 30 = 21\%$$

Now consider you are receiving 10 L/min of oxygen via a face mask at an FiO^2 of 100%
peak inspiratory flow rate of 30 L/min, but 10 L/min is being blown in your face via the
you still need another 20 L/min to meet your inspiratory flow requirements. Where are
from? You are going to suck it in from the surrounding atmosphere with an FiO^2 of 21%
same formula as before:

$$(10 \times 100) + (20 \times 21) = 1420\%$$

$$1420 \div 30 = 47\%$$

However, if you had an **increased peak inspiratory flow rate** of 50 L/min but were still
of oxygen via a **face mask** at a FiO^2 of 100%:

$$(10 \times 100) + (40 \times 21) = 1840\%$$

$$1840 \div 50 = 37\%$$

Or a **decreased peak inspiratory flow rate** of 20 L/min while receiving 10 L/min of oxy
an FiO^2 of 100%:

$$(10 \times 100) + (10 \times 21) = 1210\%$$

$$1210 \div 20 = 60\%$$

How is This Practically Relevant to Me?

In the above examples, **nothing changed with the oxygen flow rate being delivered t**

The only thing that changed was the patient's inspiratory flow demand and how much
oxygen being delivered with the FiO^2 of 21% found in room air. **We can never accurate**
of a patient is unless we accurately know what their peak inspiratory flow is, or we are
oxygen at a rate that is estimated to be greater than their peak inspiratory flow. The c
that we sometimes see equating an oxygen flow rate to a FiO^2 assume a peak inspirat
min, but it is merely an approximation.

The Most Important Take Home Points are as Follows:

1. It is an ***increase*** in FiO^2 that increases the oxygen saturation of a patient, ***not*** the
2. As ***peak inspiratory demands change*** for a patient, ***so will the oxygen flow rate***
   maintain a consistent FiO^2
3. Effective oxygen therapy is about finding ***a balance between delivering the lowe***
   achieve normal oxygen saturations for the patient.

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